

DOCUMENT RESUME

ED 146 039

SE 023 241

TITLE Aptitude Test Scores of Prospective Graduate Students in Science Remained Essentially the Same from 1970 to 1975.

INSTITUTION National Science Foundation, Washington, D.C. Div. of Science Resources Studies.

REPORT NO NSF-77-318

PUB DATE 26 Sep 77

NOTE 6p.; Not available in hard copy due to marginal legibility of original document

EDRS PRICE MF-\$0.83 Plus Postage. HC Not Available from EDRS.

DESCRIPTORS *Achievement; *Engineering; Evaluation; *Graduate Students; Science Education; *Sciences; Test Interpretation; *Tests

IDENTIFIERS *Educational Testing Service; *Graduate Record Examinations

ABSTRACT

Presented is a summary of an Educational Testing Service (ETS) review of mean scores on the Graduate Record Examination (GRE) of candidates for graduate study in science and engineering fields for the period 1970-1975. Test results were found to have remained essentially stable over the period within each particular field. Significant differences between fields were found, with science and engineering candidates averaging more than one standard deviation higher than non-science fields in quantitative ability. No difference in verbal ability occurred on the average between science and non-science groups; however, within the science fields, engineering candidates averaged noticeably lower than the others. Education candidates averaged lowest of all groups in both verbal and quantitative mean scores. (SL)

* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *

ED146039

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

SE

NSF

SCIENCE RESOURCES STUDIES

HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION • WASHINGTON, D. C. 20550 • SEPTEMBER 26, 1977 • NSF 77-318

Aptitude Test Scores of Prospective Graduate Students in Science Remained Essentially the Same from 1970 to 1975

- A recently completed NSF-sponsored study, addressing the issue of whether in recent years there has been a decline in the quality of candidates for graduate study, has found that over the period 1970-75 there were no changes of practical significance in aptitude-test mean scores among prospective graduate students in science and engineering (S/E) fields.
- Within each of the major broad S/E fields, the mean scores of candidates on the verbal and quantitative aptitude test of the Graduate Record Examination (GRE) were found to have remained essentially stable over the observed period. Thus, insofar as the abilities measured by these tests are concerned, there have been no declines of significance in the quality of applicants for science graduate study.
- The major differences in verbal and quantitative aptitude observed in the study were those between students in different fields, and these differences occurred consistently over the whole period. In quantitative ability, candidates for admission to graduate study in S/E fields averaged more than one standard deviation higher than candidates in non-science fields, and within S/E fields, examinees in engineering and the mathematical and physical sciences averaged nearly one standard deviation higher than those in the life and basic social sciences. In verbal ability, the science and non-science candidates did not differ on the average, but within the science group engineering candidates averaged noticeably lower than the others. The study was carried out by the Educational Testing Service (ETS).

Recent Influencing Developments

The recent past has witnessed a number of developments that might be expected to influence negatively the career choices of students who have the potential to be scientists and/or engineers. Among these developments are projections of an imbalance between the supply and the utilization of doctorates in S/E fields, and an increased interest in fields such as business, law

and medicine. Some very able students, motivated primarily by nonpecuniary factors, may be expected to pursue careers in science and engineering without regard to employment possibilities. Others, equally able, may, on the other hand, respond to what they perceive as unfavorable prospects for employment or for the attainment of desired levels of income in S/E professions. In this context it becomes of interest to examine the possibility of significant changes in recent years in the ability patterns of students entering graduate study in S/E fields.

There is, however, no readily available source of information on the tested abilities of persons actually admitted to graduate study in S/E fields. Therefore, this study focused on possible changes in the abilities of applicants for admission to graduate study in these fields, using information from the historical file of scores on the Graduate Record Examination (GRE). Since the scholastic aptitude tests of the GRE are the same for all applicants regardless of the field of intended graduate study, these files can also supply information on trends over recent years in the abilities of applicants for admission to graduate study in non-science fields, which can be compared to those of science-field applicants in the same period.

Aspects of the GRE

The GRE consists (1) of scholastic aptitude tests that yield a verbal and a quantitative score, and (2) of subject-matter tests in 19 different subject-matter areas. A high proportion of examinees take only the aptitude tests, since many American graduate schools require only those and not the subject-matter tests. For the purposes of the ETS study under discussion here, only aptitude-test scores were used, since subject-matter test scores were not available for many applicants in a field over the years in question, and since one of the main purposes of this study was a comparison of trends in the aptitudes of S/E applicants with those of applicants for admission to graduate study in non-science fields.

(Prepared in the Science Education Studies Group, Division of Science Resources Studies)

023 241

Trends in Graduate Record Examination test scores: 1970-71 to 1974-75

[Number of cases, mean scores and standard deviations for verbal and quantitative aptitude tests by prospective field of graduate study and by year]

Prospective field of graduate study	Aptitude	1970-71			1971-72			1972-73			1973-74			1974-75			All years		
		Number	Mean	S.D.	Number	Mean	S.D.	Number	Mean	S.D.	Number	Mean	S.D.	Number	Mean	S.D.	Total no	Mean	S.D.
Science																			
Physical sciences	V Q	499	512 650	136 106	323	500 643	134 109	474	519 648	130 105	454	502 648	126 113	526	508 630	133 110	2,276	509 644	130 106
Mathematical sciences	V Q	415	517 675	141 104	248	495 673	135 91	362	510 676	131 96	404	513 675	139 97	384	506 661	126 104	1,813	509 672	136 99
Engineering	V Q	665	444 656	132 98	372	448 651	122 97	544	455 665	132 93	573	449 663	133 100	594	440 649	127 103	2,748	447 657	129 99
Life sciences	V Q	1,036	491 556	122 120	716	491 553	122 122	1,069	504 570	117 118	1,202	508 569	121 117	1,347	509 568	116 118	5,370	502 564	119 120
Basic social sciences	V Q	2,085	533 530	117 118	1,570	527 526	116 120	2,176	522 521	120 125	2,153	525 521	119 127	2,185	521 518	120 128	10,169	525 523	121 124
Nonscience																			
Health professions	V Q	358	500 496	114 119	256	502 501	108 117	376	509 508	107 120	471	508 507	113 120	597	502 513	103 119	2,058	504 506	110 120
Education	V Q	2,993	472 462	110 120	2,120	463 457	112 119	2,988	452 450	113 119	2,953	449 442	113 120	2,745	454 445	113 120	13,799	458 451	112 120
Arts and humanities	V Q	2,686	546 494	118 118	1,659	534 492	117 116	2,571	537 493	120 122	2,574	541 494	125 121	2,405	542 490	121 120	11,895	540 493	123 118
Applied social sciences	V Q	983	492 480	113 121	694	482 475	111 123	1,038	484 475	121 126	1,180	493 477	121 122	1,270	488 464	118 123	5,165	488 474	119 122
Other nonsciences	V Q	880	496 498	124 123	580	490 500	124 119	961	501 502	125 121	917	498 495	124 128	901	496 498	125 126	4,239	497 499	123 122

Note: V=Verbal, Q=Quantitative, and S.D.=Standard Deviation
Sources: Educational Testing Service and National Science Foundation

Calculated by NSF using formula
$$S.D.(x) = \sqrt{\frac{\sum_{i=1}^5 (n_i \bar{x}_i^2 + (n_i - 1) s_i^2(x))}{N} - N\bar{x}^2}$$

where S.D.(x) = the standard deviation of the scores in a given field in a given test for the entire 5-year period; n_i = the number in the field in the i th year of the period; \bar{x}_i = the mean score in the test of those in the field in the i th year; $s_i^2(x)$ = the standard deviation of the test scores of those in the field in the i th year; N = the total number in the field over the 5-year period; and \bar{x} = the mean score of the entire group (N) in the test.

Field Classification of Students

The study was based on a one-to-fifteen sampling of those cases in the GRE historical file for the period under examination for which data necessary to the study were available. The students were classified according to the field of the department to which their GRE scores were to be sent rather than by their undergraduate majors. Departments or subfields of intended study were grouped in accordance with a broad-field break of 10 fields—five science and five nonscience. The five major fields into which S/E candidates were classified were engineering and the physical, mathematical, life, and basic social sciences.¹

Scores on GRE Aptitude Tests

The accompanying table displays, by field and year, the mean scores in the verbal and quantitative aptitude tests found among the sample of graduate-student applicants in the 10 broad fields into which students were classified for the purpose of this investigation. Also displayed for each field are the number of cases in the sample and the standard deviations of the two test scores in each year. The last columns of the table show the mean test scores and standard deviations for all of the sample candidates in each field over the entire 5-year period.

Some weak trends within fields could be observed over the period. In the life sciences, verbal mean scores tended to increase slightly, while those in the basic social

sciences tended to decrease.

Chart 1 displays, for each of the 10 broad fields of study for the entire 5-year period, the mean scores in both verbal and quantitative aptitude, the verbal score on the vertical axis and the quantitative on the horizontal. (These are the mean scores that appear in the last column of the accompanying table.)

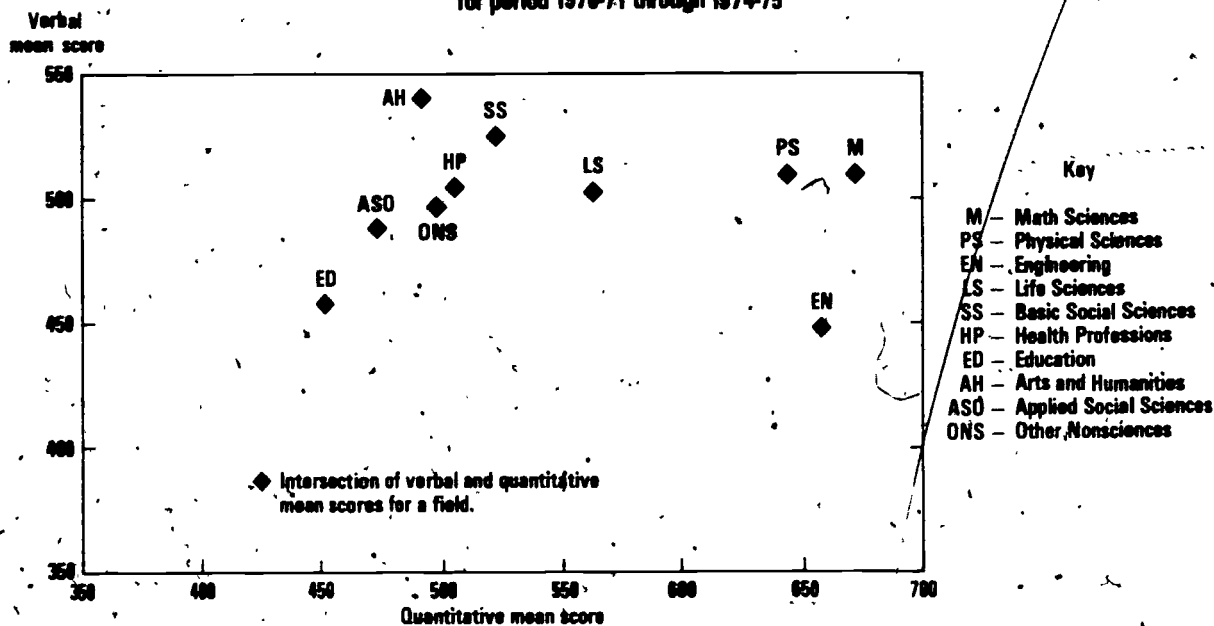
Comparisons of the Science Groups

Chart 2 displays the points shown in chart 1 for the five science fields and also illustrates, in the form of five rectangles, the areas within which the scores of the middle 50 percent of the examinees in each S/E field fell over the 5-year period. Chart 2 shows that in quantitative aptitude there is a greater degree of homogeneity and less variation within engineering and the mathematical and physical sciences groups than there is within the life and social sciences groups. In verbal aptitude, on the other hand, there is more variation within the mathematical and physical sciences and engineering groups than there is within the life and social sciences groups. As for similarities between candidates in different fields, the two groups that have the greatest overlap are the physical and mathematical scientists, with their verbal means identical and their verbal interquartile ranges (25th to 75th percentile) highly similar. In their quantitative means and interquartile ranges, they are likewise fairly close to each other.²

¹ The full report of this study contains a detailed list of the subfields which are included within each of the 10 broad field categories. (For information on obtaining a copy of the full report, see the last page of this Highlights.)

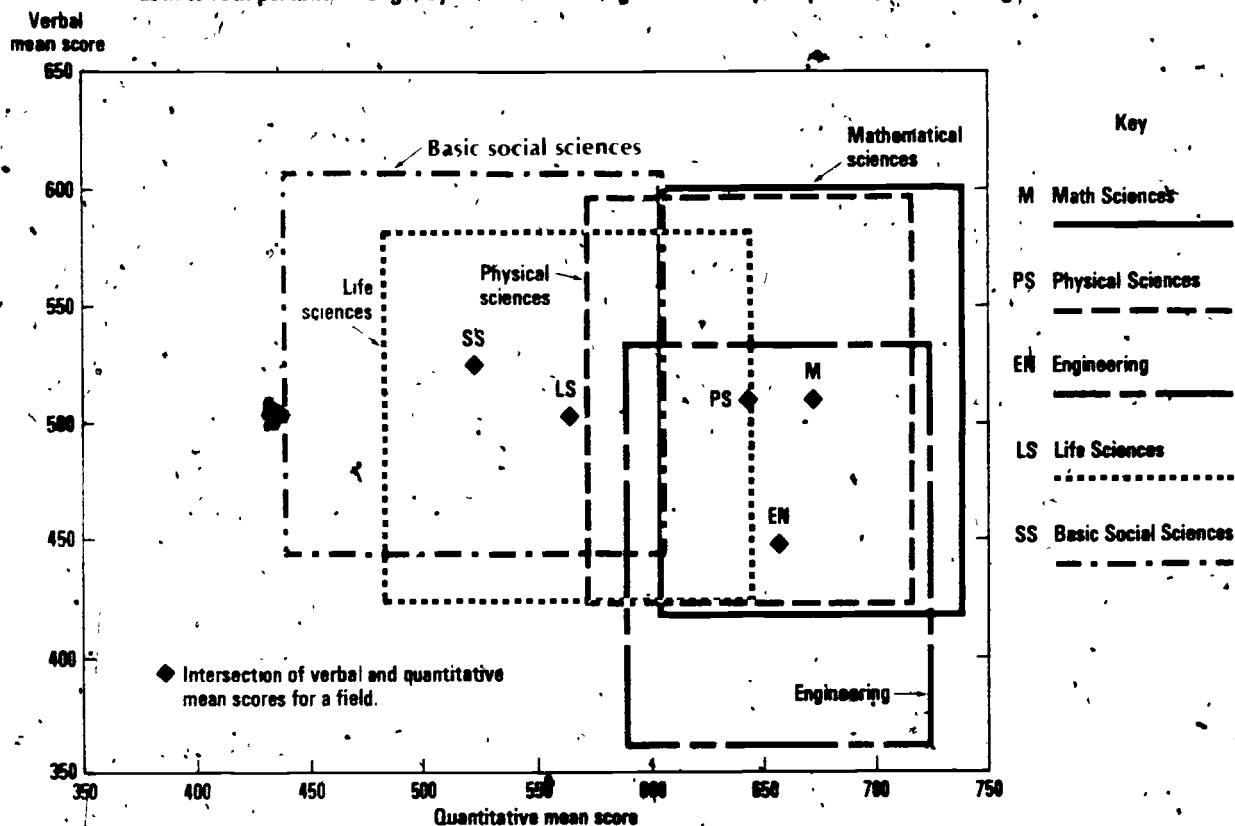
² The determination of the interquartile ranges of the scores in the several fields here was based on the assumption that the distribution of scores within each field was normal; accordingly, ± 675 of the standard deviation was the value used to calculate the magnitude of this range.

CHART 1: GRE^a verbal and quantitative aptitude test mean scores, by intended field of graduate study, for period 1970-71 through 1974-75



^aGraduate Record Examination
SOURCE: Educational Testing Service and National Science Foundation

CHART 2. Science/engineering applicant GRE[®] verbal and quantitative aptitude-test scores: mean scores and 25th to 75th percentile range, by intended field of graduate study, for period 1970-71 through 1974-75



*Graduate Record Examination

SOURCE: Educational Testing Service and National Science Foundation

The full report of this study contains, in addition to the list of subfields referred to above, coefficients of correlation and analyses of variance of the scores on the verbal and quantitative aptitude tests, by field and year, and technical notes on such aspects of the study as the sampling plan used, the comparability of GRE tests from

year to year, etc. Single copies of the full report, *Trends in Aptitudes of Graduate Students in Science* by Robert F. Boldt of the Educational Testing Service, are obtainable from the Division of Science Resources Studies, National Science Foundation, Washington, D C 20550

National Science Foundation

Washington D C 20550

Official Business

Penalty for Private Use \$3

Postage and Fees Paid
National Science Foundation

THIRD CLASS
Bulk Rate

